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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

BMM 1014 – MATHEMATICS FOR MANAGERS
(All Sections / Groups)

5 OCTOBER 2015
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 7 pages with 5 questions only.
2. Attempt any **FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. Formulae are attached at the end of the question paper.

QUESTION 1

(a) Future Tech, a computer manufacturer, has a monthly fixed cost of RM500, 000 and a production cost of RM1200 for each computer manufactured. The computers sell for RM1950 each.

(i) Find the monthly break-even quantity of Future Tech. (3 marks)

(ii) How many computers should Future Tech manufacture and sell to make a 10% profit over the cost of making the computers? (4 marks)

(iii) If Future Tech is making a loss of RM50, 000 per month, how many additional computers need to be manufactured and sold to make a profit of RM25,000? (4 marks)

(iv) In order to increase the profit, Future Tech has decided to increase the selling price. What should be the selling price of the computer in order for Future Tech to earn a profit of RM200, 000 on 900 computers? (3 marks)

(b) A furniture factory manufactures three models of tables, models A, B, and C. Each model A table requires 2 hours of cutting, 3 hours of assembly, and 1 hour of finishing. Each model B table requires 5 hours of cutting, 4 hours of assembly, and 6 hours of finishing. Each model C table requires 3 hours of cutting, 1 hour of assembly, and 4 hours of finishing. There are 1950 hours available each week in the cutting department, 1490 hours in the assembly department, and 2160 hours in the finishing department. How many tables of each model should be manufactured each week if all available time is used?? (11 marks)
(Total: 25 marks)

Continued...

QUESTION 2

A farmer mixed two brands of fertilizer in order to make the plant grow well. Brand P cost RM 150 per kg while brand Q costs RM 175 per kg. Each kg of brand P contains 40 units of nutritional element A, 120 units of element B and 40 units of element C. Each kg of brand Q contains 20 units of nutritional element A, 40 units of element B and 45 units of element C. The minimum requirement of nutrients A and C are 600 units and 900 units respectively. However, the maximum requirement of nutrients B is restricted to 3600 units only. In order to achieve the minimum cost spent on the purchasing of fertilizer, the farmer has decided to purchase at most 50kg fertilizer of brand Q. But, the farmer needs to purchase more than 10 kg fertilizer of brand Q due to the agreement with the fertilizer retailer of brand Q.

- (a) Formulate the above problem as a Linear Programming problem. (5 marks)
- (b) Graph the above information in part (a) into a suitable diagram and shade the feasible region clearly. (6 marks)
- (c) Advise the farmer on the number of kg of each brand that should be mixed to produce a mixture having a minimum cost per kg by using the method of corner. (11 marks)
- (d) What would be the effect on the optimal solution if the market price of the fertilizer of Brand P has increased from RM 150 to RM 180? (3 marks)

(Total: 25 marks)

Continued...

QUESTION 3

(a) How long for an amount of RM10,000 to earn interest amounted of RM1,618.75 at a simple interest rate of 12% per year? (4 marks)

(b) Mr. Tan won a lottery with an amount of RM20,000. He intends to invest it in a saving account for 5 years. Bank A offers him an interest rate of 5.5% compounded quarterly and Bank B offers him an interest rate of 4.7% compounded monthly. Please advise Mr. Tan which bank to invest his money. (8 marks)

(c) If RM2000 is deposited in a saving account that earns interest at an annual rate of 5.75% compounded continuously, what is the value of the account at the end of four years? (4 marks)

(d) Jenny wishes to save for retirement. She puts RM300 into an account every month for 25 years at 3.75% compounded monthly. Find

- (i) the amount in her retirement account after 25 years. (5 marks)
- (ii) the total amount of interest that Jenny earned. (4 marks)

(Total: 25 marks)

Continued...

QUESTION 4

(a) Find the derivative of each function.

(i) $f(x) = \frac{e^{3x}+1}{x^2}$ (4 marks)

(ii) $f(x) = (4x^2 - 9)(x^2)$ (2 marks)

(b) The demand equation for a certain product is given by

$$p = \frac{1}{12}x^2 - 10x + 300$$

$0 \leq x \leq 60$. Find the value of x (in unit) and the corresponding price p (in RM) that maximize the revenue.

(7 marks)

(c) Echosmith Company has started selling a new type of guitar at the price of RM $(110 - 0.05x)$ where x is the number of guitars manufactured per day. The parts for each guitar cost RM 50 and the labour and overhead for running the plant cost RM 6000 per day.

(i) Find the revenue function R and the profit function P .

(5 marks)

(ii) Find the marginal cost function, the marginal revenue function, and the marginal profit function.

(3 marks)

(iii) Determine the level of production that maximize the profits. What is the maximum profit?

(4 marks)

(Total: 25 marks)

Continued...

QUESTION 5

(a) Find the indefinite integral $\int 5t^4\sqrt{t^5 + 1} dt$ (5 marks)

(b) As part of a quality-control program, the gift sets manufactured by JY Gift Company are subjected to a final inspection before packing. The rate of increase in the number of sets checked per hour by an inspector t hours into the 8 A.M. to 12 noon morning shift is approximately

$$N'(t) = -3t^2 + 16t + 46 \quad (0 \leq t \leq 4)$$

How many sets does the average inspector check during a morning shift?

(5 marks)

(c) A concert promoter produces two types of souvenir shirt; type A sells for \$18, and type B sells for \$25. The total revenue (in thousands of dollars) is given by

$$R(x, y) = 18x + 25y$$

and the total cost (in thousands of dollars) of producing these shirts is given by

$$C(x, y) = 4x^2 - 6xy + 3y^2 + 20x + 19y - 12$$

where x denotes thousand shirts of type A and y denotes thousand shirts of type B produced and sold. How many of each type of shirt must be produced and sold in order to maximize profit? What is the maximum profit realizable?

(15 marks)

Continued...

LIST OF FORMULA

1. Quadratic Formula

The solution of the equation:

$$ax^2 + bx + c = 0, \\ a \neq 0, \text{ are } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Simple Interest

Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

Accumulated amount, $A = P(1 + rt)$

3. Compound Interest

Accumulated amount, $A = P(1 + i)^n$, where $i = r/m$, and $n = mt$ (m = number of conversion periods per year)

4. Continuous Compound Interest

$$A = Pe^{rt}$$

5. Effective Rate of Interest

$$r_{\text{eff}} = (1 + r/m)^m - 1$$

6. Present Value for Compound Interest

$$P = A(1 + i)^{-n}$$

7. Future Value of an Annuity

$$S = R \left[\frac{(1+i)^n - 1}{i} \right] \quad (S = \text{future value of ordinary annuity of } n \text{ payments of } R \text{ dollars periodic payment})$$

8. Present Value of an Annuity

$$P = R \left[\frac{1 - (1+i)^{-n}}{i} \right]$$

(P = present value of ordinary annuity of n payments of R dollars periodic payment)

Continued...

9. Amortization Formula

$$R = \left[\frac{Pi}{1 - (1 + i)^{-n}} \right] \quad (R = \text{periodic payment on a loan of } P \text{ dollars to be amortized over } n \text{ periods})$$

10. Sinking Fund Formula

$$R = \left[\frac{Si}{(1 + i)^n - 1} \right] \quad (R = \text{periodic payment required to accumulate } S \text{ dollars over } n \text{ periods})$$

11. Break-even point = $\frac{\text{Fixed Cost}}{\text{Contribution per unit}}$ (Contribution per unit = unit selling price – unit variable cost)

Sales (unit) = $\frac{\text{Fixed cost} + \text{Target profit}}{\text{Contribution per unit}}$

Calculus

12. Product rule

$$f(x) = u(x) \cdot v(x)$$

$$f'(x) = u(x) \cdot \frac{dv}{dx} + v(x) \cdot \frac{du}{dx}$$

13. Quotient rule

$$f(x) = \frac{u(x)}{v(x)}$$

$$f'(x) = \frac{v(x) \frac{du}{dx} - u(x) \frac{dv}{dx}}{[v(x)]^2}$$

End of Paper